



SMART ROAD DIVIDER ... SOLUTION FOR TRAFFIC CONGESTION.

Shrikrushna V. Jadhav

Student, Civil Department, RMD Sinhgad Technical Institute Campus, Warje, Pune, India – 411058.

ABSTRACT

Traffic is a major problem in the modern era with the increase in population there is increase in the number of vehicles, road users which end in congestion of traffic.

The static road infrastructure is almost the same and unable to cope with changes like congestion, unpredictable travel time, delay and road accidents that taking a serious shape and due to this there is need to control the road traffic with help of traffic control optimizer.

In spite of measures being taken to migrate and reduce traffic, it becomes major concerned faced by the metropolitan cities during the planning of cities it has emerged as one of the main challenges for developing cities. To find out appropriate measures there is a necessity of identify magnitude of traffic congestion.

The construction of new road or widening of existing road is not feasible every time it will result in additional traffic congestion the total available space within the city for the construction of road, railway and other transportation are restricted.

This study focuses on the implementation of movable traffic dividers to solve the traffic congestion problem in metropolitan cities.

KEYWORDS: Static road divider, Traffic congestion, Peak hours, Movable road divider, Road widening, Road efficiency.

INTRODUCTION:

In today's world, population is increasing continuously as the rate of birth increases proportional to the rate of death due to advanced progress in medical science. This is a good thing but at the other side, we are still stuck on conventional energy resources for our daily energy needs.

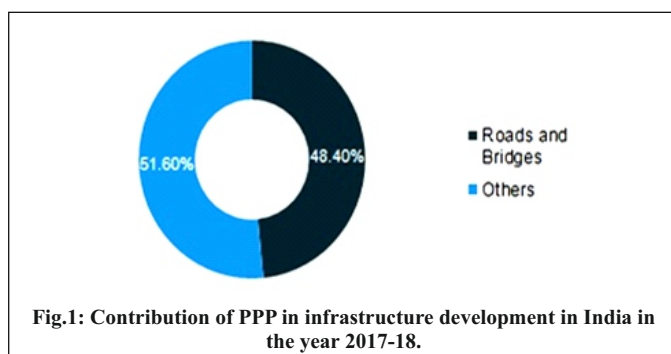
People tend to use personal vehicle instead of public transport system. There are many reasons behind this fact like failure of Public Transport System at users requirement, public system cannot provide service to any desired place, requirement to change mode of transport to reach particular destination which sometimes undesirable to the user.

In developing countries like India due to lack of public transport system, people purchased personal vehicles. In 2015 registration of vehicles in India touched on all-the time high of 1.96 crores which means in actual almost 53,720 vehicles hits the road every single day in India.^[1] Adjusted for the large population, India has less than 3.8km of road per 1000 people.^[9]

As compared to increase in the vehicles per year, working of new road and implementation of solutions for heavy fresh traffic created by new vehicles is very less. The Ministry of Road Transport and Highways has fixed a target of 20,000 km for 2018-19 which is 25 percent more than 17,055 km awarded in 2017-18.^[2] Condition of roads and their capacity is not enough compared to increasing daily traffic.

Traffic congestion is the phenomenon where movement of vehicles get slow down or nearly zero which leads to increase in vehicular queuing and ultimately increases journey times. Traffic congestion does not only increase journey time but also directly impact on country's productivity. 40% productivity is decreases due to wasted time in daily traffic.^[3]

Traffic congestion classified in two groups namely Traffic at only one side of divider and Traffic on both side of road divider.

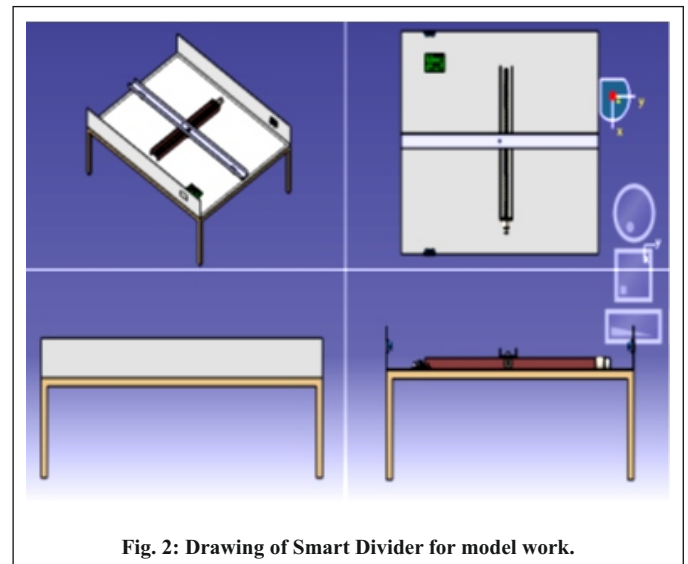


When traffic is at only one side of divider there is a necessity to provide some extra space to the side where traffic is congested from another side having very light compared to congested side.

At this situation, Movable Divider is required to do such action with the help of linear actuator for horizontal transverse movement to the road alignment.

Components:

1. Divider
2. Sensors
3. Micro Controller
4. Linear actuator
5. Motor



- 1) **Divider:** Fiber Reinforced polymer is used to make road divider block. Road divider works to divide road area into two opposite direction to which vehicles are moving. Divider made up of using FRP material is lightweight and more durable than of concrete divider. This ultimately saves energy consumption to move it in lateral direction with the help of actuators.
- 2) **Sensors:** Sensors are used to detect density of traffic across particular road section where they are placed and thus they warn after predetermined traffic density to indicate congestion of traffic across that section of road. Ultrasonic sensor, Infrared sensor, Image processors can be used as a sensor. Out

of this ultrasonic sensor is suitable. HC-SR04 is an ultrasonic sensor having a range of 2cm – 400 cm to detect objects and find out its distance from the sensor.

Specification of Ultrasonic sensor HC-SR04

- Power Supply: +5VDC
- Working current: 15mA
- Effectual Angle: <15°
- Ranging Distance: 2cm - 400 cm
- Resolution: 0.3 cm
- Measuring Angle: 30°
- Trigger Input Pulse width: 10 μ S
- Dimension: 45mm x 20mm x 15mm
- Weight: approx. 10 g

- 3) **Microcontroller:** Arduino Uno is an open-access microcontroller. AT Mega 328 is Arduino Uno type microcontroller having 14 pins with it. Programs are written in language of C and C++ for microcontroller. Microcontroller is used to control the movement of the divider and operate automatically with the help of sensors and linear actuators.

Specification of Arduino Uno Microcontroller:

- Operating Voltage: 5V – 12 V
 - Digital I/O Pins: 14 total – 6 of which can be PWM
 - Analog Input Pins: 6
 - Maximum DC Current per I/O pin at 5VDC: 40 mA
 - Maximum DC Current per I/I pin at 3.3 VDC: 50 mA
 - Flash Memory: 32KB
 - SRAM Memory: 2KB
 - EEPROM: 1KB
 - Clock Speed: 16 Mhz
- 4) **Linear actuator:** Linear actuators are used below the road divider to move it laterally. Lead screw mechanism is used for movement of divider. Mild Steel is used for making Lead screw and stud as it is durable and strong. Grooves are provided at a certain distance around 2 – 3 meters in length of every section of divider.
- 5) **Motor:** Here D.C. motor is used for giving motion to the driving mechanism. Rotary motion of motor is converted into linear motion with the help of threads on Lead screw and Stud. DC motor's speed can be controlled over a large scale by changing given electric supply current.

Test and Results:

Table 1: Tests are performed on model of prototype.

Traffic at side	Divider position	Distance covered	Time consumption
Left	Right	20 cm.	3 min. 32 sec.
Right	Left	20 cm.	3 min. 30 sec.
Both side	At Center	-	-

DISCUSSION:

When the traffic is at left, divider shifts to the right and vice versa at given distance generally width of one lane, but it is not capable to detect that congestion of traffic is reduced and flow becomes smooth at previously congested lane so it does not come back to center.

This limitation of model is due to the limitations of microcontroller used but can be overcome by using and developing advanced microcontroller integrated with super computer having cloud system which automatically take decision about the position of further divider after detecting congestion of traffic at successively previous divider section alike signal system embedded with cloud system.

LIMITATIONS OF STUDY:

- Not applicable if both sides are completely congested.
- Problem of maintenance.
- Skilled supervision staff and technicians required.

CONCLUSIONS:

The movable divider is capable of providing extra lanes with certain specified width to traffic congested side of road, by acquiring one lane of another side which carries light traffic at that time. Provision of lanes to a congested side totally depends on 'either another directing side of the road is also congested or not?' Thus by providing the suggested mechanism, we can use the width of the road to its full efficiency.

The divider is said 'Smart' because it can detect the congestion through sensors and thus microcontrollers send signals to divider to slide. So, basically movable divider is used to solve problems of traffic congestion on one side of the road with other side is free from heavy traffic. By doing this we can use road width at its full efficiency without widening of road which ultimately helps to preserve acquired land for other purposes besides of road from the unnecessary widening of road, which also leads to reduce cost of the widening of road, land acquisition and compensation. By using renewable energy sources, we can reduce the operating charge of the movable divider.

Acknowledgments:

It gives me immense pleasure to express my sincere thanks with deep sense of gratitude to 'IERJ', for giving me such opportunity to publish my paper.

I also wish to say thanks with gratitude to 'Editor's in chief', for guidance and responsive support throughout this process of the paper submission.

REFERENCES:

Online sources:

1. Dipak k. Dash, D, (2016): 53,700 vehicles registered across country every day, available at <https://timesofindia.indiatimes.com/auto/miscellaneous/53700-vehicles-registered-across-country-every-day/articleshow/53747821.cms>, accessed 10 June 2018.
2. India Brand Equity Foundation, (2018): Road and Infrastructure Industry Analysis, available at <https://www.ibef.org/industry/roads-presentation>, accessed June 2018.
3. Mahlon Apgar, M, (1994): The Alternative Workplace: Changing Where and How People Work, available at <https://hbr.org/1998/05/the-alternative-workplace-changing-where-and-how-people-work>, accessed June 2018.

Survey:

4. Traffic Forecast for the Proposed Metro Rail Project in Pune Metropolitan Area Report on Methodology and Data Submitted by Transportation Systems Engineering Group Civil Engineering Department Indian Institute of Technology Bombay Powai, Mumbai-400 076

Journal Papers:

5. A. Siddique & S. Iffat, Effects of traffic demand management in reduction of congestion in Dhaka city
6. Kuei-Hsiang Chao and Pi-Yun Chen, An Intelligent Traffic Flow Control System Based on Radio Frequency Identification and Wireless Sensor Networks. (2014)
7. Nilesh Patil, Parth Srivastava, Milan Ghori, Dharmik Dave and Darshan Jain, Public Cloud Integrated Road Lane Divider System, (2016).
8. Papageorgiou, Diakaki, Dinopoulou, Kotsialos, and Wang, Review of Road Traffic Control Strategies.
9. Rajesh Gajjar and Divya Mohandas Critical Assessment of Road Capacities on Urban Roads – A Mumbai Case-Study
10. Robert Bain, movable barrier technology-key to dynamic highway.
11. Roxanne Hawi, George Okeyo, Michael Kimwele, Techniques for Smart Traffic Control: An In-depth Review, (2015).
12. Saili Shinde, Sheetal Jagtap Intelligent Traffic Management Systems: A Review, (2016).
13. Sanjay N More, Mr. S. S. Chavan, Human Safety: Composite Road Divider, (2015).
14. SP Shepherd, A Review of Traffic Signal Control.
15. Tao Yang and Li Kang Research on Intelligent Traffic Control System Based on Hybrid Genetic Algorithm.